

## Strengthening Hydro-Meteorological and Early Warning Services in the Caribbean

<b>1</b>	<b>Project Title</b>	<b>Strengthening Hydro-Meteorological and Early Warning Services in the Caribbean</b>	
<b>2</b>	<b>Project Reference</b>	CREWS/RProj/04/Regional Project Caribbean	
<b>3</b>	<b>Geographic coverage</b>	Caribbean Community (CariCom) Member States	
<b>4</b>	<b>Timeframe</b>	3 years	
<b>5</b>	<b>Total cost of CREW contribution</b>	<b>US\$ 5.5 million</b>	
<b>6</b>	<b>Implementing Partner</b>	<b>The World Bank/GFDRR</b>	
		a. Allocation Requested for Execution by Government	
		b. Allocation Requested for Execution by Partner	
		c. Fees of Implementing Partner:	
		d. Co-financing provided by Partner(s)	
		d. Total requested	TBD
<b>7</b>	<b>Additional Implementing Partners</b>	<b>WMO</b>	
		a. Allocation Requested for Execution by Partner	
		b. Fees of Additional Implementing Partner:	
		c. Total requested:	TBD
<b>8</b>	<b>Additional Implementing Partners</b>	<b>UNISDR</b>	
		a. Allocation Requested for Execution by Partner	
		b. Fees of Additional Implementing Partner:	
		c. Total requested:	TBD
<b>9</b>	<b>Total Project Amount</b>	<b>US\$ 5.5 million</b>	
<b>10</b>	<b>Main objective</b>	To strengthen and streamline regional and national systems and capacity related to weather forecasting, hydrological services, multi-hazard impact-based warnings and service delivery for enhanced decision-making.	
<b>11</b>	<b>Initial state of play - project rationale</b>		
	a. Vulnerability, exposure to risks, disasters impacts (on people and economy)	The Caribbean region is highly exposed to natural hazards, in particular hydrometeorological hazards such as hurricanes and tropical storms, floods, landslides and storm surge, and has suffered in the past from numerous significant impacts. Amongst the most damaging hydrometeorological events were Hurricane Ivan's passage over Grenada which resulted in 2004 in damage and losses of about 200% of GDP, Hurricane Tomas (2010) which caused impacts representing more than 40% of Saint Lucia's GDP and Hurricane Matthew (2016) which gave rise to about 22% of GDP loss in Haiti. Tropical storm Erika hit Dominica in 2015 resulting in 11 deaths, about 7,229 persons impacted by the event and estimated damages and losses of about 90% of GDP. Most recently, Hurricane Irma devastated Barbuda resulting in the subsequent full evacuation of the island and Hurricane Maria affected,	

		<p>based on current estimates, about 70-80% of the housing stock of Dominica. According to WMO (2011)<sup>[1]</sup>, between 1980 and 2007 nearly 98% of the disasters, 99% of casualties and 99% of the economic losses in this region were related to hydrometeorological and climate related phenomena. Climate change is expected to further exacerbate hazard levels while unplanned urban expansion and inadequate construction practices are continuously increasing vulnerability.</p> <p>The capacity of National Meteorological and Hydrological Services (NMHS) as well as Disaster Risk Management (DRM) offices in the region is highly varied - in some, especially small, countries the NMHS consists of only few people with limited technical training, while others, especially larger countries or foreign territories have far higher levels of capacity, training and technology. Sharing, collaboration and coordination mechanisms are in place. Shared amongst a large number of islands is the agreement on the importance of strengthening hydromet services and EWS in the Caribbean. During the “Caribbean Early Warning System Workshop”, which took place in 2016, the need for strengthening capacity and coordination around EWS using a multi-hazards approach, was acknowledged. Furthermore, its relevance has also been expressed by Caribbean countries through the (Intended) Nationally Determined Contributions (I-NDCs) in which 9 out of 16 countries refer specifically to EWS and another 6 countries emphasize the need to address the risk of extreme climate events<sup>[2]</sup>.</p> <p>While regional agencies, particularly the Caribbean Institute on Meteorology and Hydrology (CIMH) and the Caribbean Disaster Emergency Management Agency (CDEMA), have the mandate to harmonize efforts and support national level hydrometeorological services and EWS, support from multi-lateral and bi-lateral agencies is often rather scattered and the opportunities a region with heterogeneous capacities offers in terms of distributing tasks and supporting each other is not yet very efficiently used. For instance, under the umbrella of the Caribbean Meteorological Organization (CMO) stronger national meteorological services made commitment to provide support to their less capable neighbours. However, such commitment is not always supported by resources. For example, Antigua and Barbuda Meteorological Service (ABMS) – providing forecasts to Anguilla, British Virgin Islands, Montserrat, St. Kitts and Nevis - indicated that ABMS staff do not have access to in situ data and due to lack of resources never visited these countries which makes forecasts less accurate.</p>
	<p>b. Status of the EWS, DRM agencies and NMHSs, actors / players present</p>	<p>The Caribbean Institute on Meteorology and Hydrology (CIMH) is a regional research institution specializing in meteorological, hydrological and climate research under the umbrella of the Caribbean Community (CARICOM) with the following additional roles: (i) designated WMO Regional Training Center as well as Regional Climate Centre for the Caribbean (ii) WMO Regional Instrument Centre (RIC), (iii) WMO recognized Centre of Excellence specializing in the Training in Satellite Meteorology, (iv) the WMO Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS) Centre for the Pan American region and (v) host of the Caribbean Centre for Climate and Environmental Simulations). While CIMH has very strong expertise and presence in capacity building in the region, it does not have an operational mandate in the region.</p>

<sup>[1]</sup> WMO (2011) Strengthening of Risk Assessment and Multi-Hazard Early Warning Systems for Meteorological, Hydrological and Climate Hazards in the Caribbean

<sup>[2]</sup> WMO (2017) Stocktaking – Climate Risk and Early Warning Systems – Caribbean Region

		<p>The Caribbean Disaster Emergency Management Agency (CDEMA) is the regional inter-governmental agency for disaster management in the CARICOM with the mandate to facilitate, drive and coordinate Comprehensive Disaster Management (CDM) in all Participating States. One of the Regional Outcomes is related to strengthening EWS which is aligned to the seventh global target of the Sendai Framework for Disaster Risk Reduction calling for a substantial increase of multi-hazard EWS. The Sendai Framework further refers to EWS to a critical element for disaster risk reduction.</p> <p>Many national agencies (NMHSs and DRM agencies) have limited capacity on their own to provide services given limited financial and human resources as well as technical capacity. Most NMHSs do not have a strongly user-oriented culture, partly because they do not have the legal mandate, making it challenging to define their roles, responsibilities and interactions with other agencies. The level of current annual budgets for these agencies often does not allow them to adequately maintain or invest further in their systems. Therefore, when new technologies become available, it is not always easy for these agencies to immediately benefit from them. The number of technical/professional staff of these agencies is limited and they need further training to adapt new technologies and develop new services.</p> <p>National Hydrological Services are particularly weak and have been paid little attention across the region. Many countries lack a dedicated agency for hydrological services with the ministry responsible for water and sanitation being the only body working on this topic. This leaves voids in the mandate for providing hydrological services, especially since needs for such services have become greater in recent years with greater demands for water resources and increased inter-annual variability of precipitation. Flood/flash flood and landslide warning as well as hazard mapping and ground water monitoring have become more important for decision making in many countries as the residential areas further expand to high risk zones increasing exposure of people and assets.</p> <p>National and regional level operations and capacity building around EWS are scattered and being carried out through collaboration with different development partners, regional organizations and agencies from peer countries without a coordinated and integrated approach. In order to harmonize efforts, under CDEMA's leadership, a Regional Early Warning Systems Consortium has been founded beginning of 2017, which shall serve as a strategic and advisory body for the advancement and strengthened coordination of EWS within the Caribbean Region. Being chaired by CDEMA, the EWS Consortium consists of a number of regional and national agencies as well as scientific bodies and international organizations in observer role.</p>
	<p>c. Projects and programs dealing with EWS and hydromet under implementation or preparation</p>	<p>In the following an overview of some key activities is provided - please refer to the Stocktaking exercise prepared for the CREWS Steering Committee for information on further projects:</p> <p>The following some key projects that have strengthened EWS in the region in the past and started a paradigm shift are outlined:</p> <ul style="list-style-type: none"> <li>(i) the Enhancing Resilience to reduce vulnerability in the Caribbean (ERC) Project strengthened the early warning network, significantly enhanced the computational capacity of CIMH to develop high resolution numerical weather products for region and provided a regional early warning platform that supports impacts based forecasting,</li> <li>(ii) the Programme for Building Regional Climate Capacity in the Caribbean</li> </ul>

		<p>(BRCCC) which further strengthen the regional early warning network, significantly advanced climate early warning systems in the region and further enhanced the regional computational platform for the region,</p> <p>(iii) the Advanced Flood Forecasting Pilot Project that advanced watershed level flood forecasting in the Caribbean, and</p> <p>(iv) the Caribbean Water Initiative (CariWin) under which the Caribbean Drought and Precipitation Monitoring Network was established.</p> <p>The Climate Change Adaptation Program (CCAP) – funded by USAID and implemented by CCCCC with support from CIMH – aims at promoting the use of climate data and information for the use in decision-making; support innovative adaptation approaches which demonstrate proof of concept necessary to secure additional financing; and foster climate financing to support scale up and replication of sustainable adaptation initiatives.</p> <p>Disaster Vulnerability Reduction Projects in Saint Lucia, Grenada and Dominica (World Bank and CIF<sup>1</sup> financed) which have a small component on strengthening hydromet services and partially EWS. Dedicated hydromet projects in Haiti and Jamaica (WB and CIF funded) provide more in-depth support to strengthening hydromet and EWS services through a larger financial scope.</p> <p>The Severe Weather Forecasting Demonstration Project in the Caribbean, financed by Canada and implemented by WMO aims at empowering participating national meteorological and hydrological services to maintain effective multi-hazard early warning systems with greater accuracy, more advance notice and in a manner, that is more responsive to the needs of users, including disaster management and civil protection agencies, the media and the general public</p> <p>The Regional Weather Radar System Project – funded by the EU – established a radar mosaic between a large number of Caribbean radars. Activities mentioned in the proposal at hand will build on the achievements of this project.</p>
	<p>d. Positioning of CREWS support: complementarity and synergies with the existing programs</p>	<p>While a large number of initiatives is already ongoing, complementing and strengthening of these mostly national-level activities with regional support shows, based on a diagnostic of the situation and conversations with regional and national agencies, the largest potential for success. Strengthening the regional cascading system, e.g. for weather forecasting, can in a complementary way strengthen regional, sub-regional and national capacities in order to reach optimal levels of efficiency in service provision. Furthermore, the level of efficiency of scattered support provided by donors and partners through a regional strategy and coordination mechanisms can be significantly enhanced. The regional strategy for EWS will ensure linkages to the CDM Strategy and Sendai Framework for DRR and shall be guided by regional and national policies.</p>
<p><b>13</b></p>	<p><b>Project design</b></p>	
	<p>a. Project Outputs (<b><i>Bold italic items represent activities with contribution of CREWS financing</i></b>)</p>	<p><b>Component 1) Development of regional strategy to strengthen and streamline early warning and hydromet services</b> (estimated cost US\$ 500,000)</p> <p>Specific activities could include:</p> <p>(a) Evaluation of national and regional capacities as well as services currently provided vs. user needs (DRM, climate change adaptation,</p>

<sup>1</sup> Climate Investment Fund (CIF) through the Pilot Program for Climate Resilience (PPCR)

		<p>tourism, agriculture, transport, water resources, marine) and institutional capacities of NMSs, NHSs and DRM agencies. With this information, a gap analysis will be carried out which will form the basis for the next activity;</p> <ul style="list-style-type: none"> <li>(b) Development of a strategy for strengthening institutional alignment and coordination including conceptualization of a regional “cascade” for better distribution and clear understanding of roles and responsibilities between regional, sub-regional and national levels, more efficient use of resources and more effective leverage. This step will be based on the findings from step (a) and build on/strengthen existing but often informal or not fully functional institutional arrangements between the regional, sub-regional and national level;</li> <li>(c) Develop an appropriate approach to risk informed decision making regarding EWS at the regional and national level considering existing and identifying the need risk assessments</li> <li>(d) Assessment of socio-economic benefits of better hydromet services and EWS on national and regional level and advocacy at high levels for better regional and national support in order to ensure the sustainability of investments and activities. Strengthening hydromet and early warning services requires adequate funding and this assessment of costs versus benefits shall support the communication of the required budgets in a transparent way as well as convey the benefits of such investments; and</li> <li>(e) Identification of priority investment needs and development of investment proposals for leveraging further funding from different sources including the World Bank.</li> </ul> <p><b>Component 2) Institutional Strengthening and streamlining of early warning and hydromet services (estimated cost US\$ 2,800,000)</b></p> <p>Capacity building and training activities will be focusing on comprehensive strengthening and operationalizing of a cascading forecasting system that will feed into comprehensive and coordinated early warning systems in the region. In the context of the integral cascading approach particular activities will cover the following key aspects (to be refined on basis of the findings under Component 1):</p> <ul style="list-style-type: none"> <li>(a) Institutional strengthening at regional and national level to support a clear definition of roles and responsibilities, as well as coordination to enhance the cascading forecasting system;</li> <li>(b) Strengthening of meteorological and hydrological observation, data management and weather, climate and flood forecasting;</li> <li>(c) Implementation of WMO cascading initiatives such as the Severe Weather Forecasting Demonstration Project, Global Flash Flood Guidance System, Caribbean Climate Outlook Forum, and Caribbean Early Warning Information Systems Across Climate Time Scales Consortium Meetings;</li> <li>(d) Improve utilization of Doppler radar information and other remote sense data for “now-casting” of extreme meteorological and hydrological events;</li> <li>(e) Introduction of Multi-Hazard Early Warning Systems, risk assessments and Impact-Based Forecasting;</li> <li>(f) Awareness raising with multiple actors on early warning as integrated element of disaster risk management and</li> <li>(g) Awareness raising and capacity building for priority sector users through joint training with service providers</li> </ul> <p><b>Component 3) Support for piloting high priority national activities including impact-based forecasting (estimated cost US\$ 2,200,000)</b></p>
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	b. Implementing time frame	See Annex 1
	c. Contribution to CREWS Programming Framework	<p>This project will contribute to the achievement of the following outputs in the CREWS Programming framework:</p> <ul style="list-style-type: none"> <li>▪ Regional (cascading) weather and climate monitoring and prediction products with facilitated access for CREWS Project Countries;</li> <li>▪ Pooled (regional) trainings for high impact sectors (disaster risk management, health, agriculture)</li> <li>▪ Regional monitoring, forecasting and warning products for extreme events (flood, drought, extreme heat, other weather events);</li> <li>▪ Regional inter-governmental organizations strengthened to support NMHSs and early warning capacities.</li> <li>▪ NMHSs' service delivery improved including development of impact based capacity and tailored information for risk management.</li> <li>▪ Long-term development plans for NMHSs, including the need for system interoperability at the national and regional levels.</li> <li>▪ Targeted education and public awareness programs available for warning systems and related public action.</li> </ul>
	d. Logical framework with indicators	See Annex 2
<b>14</b>	<b>Organization and operating procedure</b>	
	a. Institutional framework	<p>The project will be implemented by the World Bank in coordination with WMO and UNISDR, in close collaboration with CIMH and CDEMA.</p> <p>A Steering Committee will be assembled for this project (project steering committee - PSC) in order to support ensuring participation, harmonization and collaboration across international, regional and national stakeholders. The role of the PSC will be to provide overall oversight, policy direction on project implementation resolving any policy hurdles or policy conflicts and</p>

		supporting project risk management. The PSC will be presented with and consulted regarding the implementation plan and annual budget, and will be briefed as often as needed but at least bi-annually on project progress.
	b. Monitoring and evaluation system	The M&E system will be based on the results framework that is an integral part of the project implementation. Performance monitoring and reporting will follow current GFDRR practices for hydromet modernization projects. The indicators will be, as applicable, gender disaggregated.  Project reviews will take place on an annual or bi-annual basis and will include reporting of progress and outputs to date.
<b>15</b>	<b>Project viability and sustainability</b>	
	a. Main identified risks	<p><b>Operational risks:</b></p> <p>Low commitment to coordinate and collaborate at national and regional level (risk level moderate). In order to manage this risk it will be critical to carry out a highly participatory and transparent process, especially as it relates to the development of a regional strategy, and take small, financially and institutionally sustainable steps.</p> <p>Delays due to natural disasters (risk level moderate): Taking the example of the 2017 hurricane season, the large number of big disasters such a situation requires significant attention at regional and national level possibly leading to delays in the implementation of the project proposed in this document. In order to mitigate this risk, flexible adjustment of the sequence of activities is required. On the other side, continuous learning from disasters and the related forecasting and early warnings offers a great opportunity for this project to be relevant.</p> <p><b>Financial risks:</b></p> <p>Financial sustainability after finalization of the project: With this risk being the challenge of many ongoing projects, this proposal actually suggests to face this challenge through a dedicated activity under component 1 which aims at the analysis of costs and benefits followed by advocacy at national, high political level. Furthermore, close coordination with national level World Bank projects with hydromet/EWS activities is planned during project implementation. This should build the foundation for follow-up after the project at hand is closed.</p>
	b. Critical assumptions	<p>For the project to be successful, the following assumptions are critical:</p> <ul style="list-style-type: none"> <li>▪ Strong commitment from the regional agencies CIMH and CDEMA.</li> <li>▪ Strong interest and engagement from the NMHSs and DRM agencies in the region;</li> <li>▪ Openness and willingness to collaborate internationally, regionally and nationally;</li> </ul>
	c. Judgment on the project sustainability	<p>Sustainability of the project will be ensured in the long run through:</p> <ul style="list-style-type: none"> <li>▪ Close coordination with ongoing and future World Bank Projects: this proposed project would build on and closely coordinate with ongoing World Bank projects in order to ensure sustainability of investments from the lending operations as part of the regional cascading system with stronger regional collaboration and capacity building. On the other side, findings from this project will inform content and design of future World Bank projects and aim at continuing efforts.</li> </ul>

		<ul style="list-style-type: none"> <li>▪ Ensuring ownership by CIMH, CDEMA, supported by the Regional EWS Consortium, as well as national NMHSs and DRM agencies during project development and implementation: stakeholders participation and engagement will be an important aspect of the project development and implementation process. With the project objectives and activities being in line with regional priorities and needs, as well as realistic in scope, a critical path towards sustainability is done.</li> <li>▪ Increasing donor support and coordination: Investments made to date have resulted in limited sustainability of impact due to fragmentation of efforts, among other factors. Through the PSC and further mechanisms the project team will make sure to coordinate and harmonize efforts with activities from other donors.</li> <li>▪ Support countries to access international funds to further strengthen NMHS and DRM: Through the regional and several national gap analysis as well as the cost-benefit evaluation, the project will support countries to make a case for and access funds for further strengthening of hydromet and EWS.</li> <li>▪ Support mobilization of domestic resources to continue efforts after project finalization: Advocacy at high levels of national governments for better regional and national support and ensuring sustainability of investments is a key element of the project. The cost-benefit analysis will serve as foundation for these conversations.</li> </ul>
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	2018				2019				2020			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
<b>Component 1) Development of regional strategy to strengthen and streamline early warning and hydromet services</b>												
(a) Evaluation of user needs and institutional capacities of NMSs, NHSs and DRM agencies												
(b) Development of a strategy for strengthening institutional alignment and coordination including conceptualization of a regional “cascade”												
(c) Assessment of socio-economic benefits of stronger hydromet and EWS as well as the regional approach												
(d) Identification of priority investment needs and development of investment proposals												
<b>Component 2) Strengthening and streamlining of early warning and hydromet services</b>												
(a) Institutional strengthening at regional, sub-regional and national level of NMSs, NHSs and DRM agencies												
(b) Strengthening of hydrological observation, data management and flood forecasting												
(c) Implementation of WMO cascading initiatives												
(d) Improve utilization of Doppler radar information for “now-casting” of extreme meteorological and hydrological events												
(e) Introduction of Multi-Hazard Early Warning Systems, risk assessments and Impact-Based Forecasting												
(f) Awareness raising with multiple actor on early warning as integrated element of disaster risk management												
(g) Awareness raising and capacity building for priority sectoral users through joint training with service providers												
<b>Component 3) Support for piloting high priority national activities including impact-based forecasting</b>												
a) Identification of pilot countries, priority activities and coordination with component 1 findings												
b) Implementation of activities in close coordination with regional activities												

**Strengthening Hydro-Meteorological and Early Warning Services in the Caribbean**  
**Concise Logical framework with results and impacts indicators**

Objective	Indicator	Means of Verification (MoV)	Baseline	Target	
				Mid-term (if applicable)	Final
<b>Strengthening of Regional Hydromet Services and EWS</b>	Regional cooperation strategy agreed with regional and national stakeholders	Report, including the strategy and socio-economic benefits analysis, finalized and confirmed at regional and national levels	TBD	+1	1
	Operating procedures support regional cooperation strategy	Operational procedures and official agreements supporting cascading forecasting and coordination mechanisms on early warning systems are in place and endorsed by the regional and national level	TBD	+ 1	+ 3
	Long-term development strategy	Long-term development strategy and list of priority investments identified	TBD	+1	1
<b>Strengthening on National Hydromet Services and EWS</b>	Piloting Multi-Hazard Early Warning Systems and Impact-Based Forecasting	Number of countries with MHWS and IBF	TBD	+1	+3
	Number of beneficiaries reached by new/enhanced early warning systems and other risk reduction measures	Number of people located in high risk areas that are better prepared and informed before a major hydromet event strikes (including ratio between females and males)	TBD	+1,000	+ ,000
<b>Institutional Strengthening and Capacity Building</b>	Number of professionals trained	Signature and instructors' validation on the participation sheets	0	40	80
	Availability of better/more relevant/higher quality regional guidance tools for impact-based forecast and warning services	Survey of satisfaction of national level users	TBD	TBD	TBD
	Availability of better/more relevant/higher quality products for at least one priority sector	Survey of satisfaction of sectorial users	TBD	TBD	TBD